NEW GEL-COAT ADDITIVATED WITH TITANIUM DIOXIDE AND ALUMINA PARTICLES

FIELD OF THE INVENTION

[0001] This invention falls within the field of advanced composite materials, in particular the field of catalysis. Specifically, this invention refers to the resulting composite materials, which have in their formulation photocatalytic additives such as TiO_2, as well as to its preparation procedure. The composite material obtained has direct application in the construction field, transport by road, rail, air or sea, as well as in the environment in general, as this type of material has self-cleaning, biocidal and deodorizing properties, including decontamination properties in the presence of air and ultraviolet light.

BACKGROUND OF THE INVENTION

[0002] Atmospheric Pollution. NOx and their Photochemical Degradation Through Photocatalytic Coatings.

[0003] Atmospheric pollution causes around 370,000 premature deaths throughout the EU, and around 16,000 in Spain, according to European Commission data. Taking into consideration that these death figures are at least 4 times higher than the ones caused by traffic accidents, this problem takes on an important enough dimension for its scope to be studied and analyzed in detail. According to the European Environment Agency, traffic is one of the major sources of atmospheric pollution in Europe, followed by thermal and industrial plants. In Spain, 34% of nitrogen oxides (NOx) emissions are derived from traffic. In addition to NOx, the atmospheric pollutants with the greatest impact on health are particulate matter (PM) emitted by motor vehicles and industry, along with sulphur dioxide from fossil fuels and diesel fuels. Air quality in urban areas is heavily affected by traffic, this being the primary source of atmospheric emissions of particulate matter (including engine, brake wear, tyres and road surface particles, as well as certain metals related to mechanical wear) and gases such as NOx (generic term encapsulating NO and NO2).

[0004] Particulate matter and NOx, together with the ozone and ammoniac, are critical parameters to be in compliance with air quality legislation in cities in Spain and Europe in general. Additionally, NOx contributes to air photochemical pollution, giving rise to what is known as "photochemical smog." This term refers to a complex mixture of products produced from the interaction between sunlight and two of the main composites of motor vehicle exhaust gases, namely nitrogen monoxide and hydrocarbons. Their interaction in the presence of sunlight leads to the formation of highly oxidizing fog, which in the past has provoked severe pollution episodes in big cities. In urban areas, approximately 50% of the NOx emissions are produced by engine combustion in vehicles, while other emission sources are power plants and other industrial sources (U.S. EPA, 1998). The high levels of NOx, in addition to affecting the ozone levels (a secondary pollutant generated in the atmosphere by the reaction of NO2 and organic gaseous precursors) and the formation of acid rain, may adversely affect public health, especially affecting the respiratory system.

[0005] While acknowledging the diversity of emission sources, road traffic is one of the main sources which affect the urban population's exposure level to atmospheric pollution. This is due to the fact that the emission is produced in close proximity to the population and in a dispersed manner in large cities. Although motor vehicles comply with increasingly demanding environmental regulations, their continual growth and permanent and progressively indiscriminate use, as well as the growing proliferation of diesel vehicles in the vehicle population, lead to an increasingly complex situation.

[0006] The possibility to be able to protect building or vehicle surfaces through coatings capable of degrading this type of organic composites found in the air with which they are in contact, contributing to environmental decontamination and self-cleaning of these surfaces, is highly interesting. Thus, nanoparticle-based coatings which provide physical-chemical properties different from the already existing materials are being researched, in order to offer solutions to the aforementioned problems.

Problems in the Shipping Sector Due to the Attachment of Sea Life. Photocatalytic Coatings on Vessel Surfaces: A Low-Cost Solution.

[0007] In the maritime transport sector, around 36 billion euros per year are spent on non-stick paint and additional fuel costs in order to overcome the induced resistance due to the attachment of sea life to vessel hulls (between 30 and 45% more), making this an increasing issue taking into account global warming. As a result, this sector seeks technical solutions capable of diminishing these effects on vessels.

[0008] With the use of these new types of materials on the surfaces of vessels, it has been proven that they prevent the growth of bacteria, algae and fungi on certain surfaces, as these materials have a biocidal effect partly thanks to the appearance of hydroxyl radicals. Thus, the use of this type of materials in the manufacturing of new vessels is a real possibility to reduce maintenance and fuel costs.

Components of Heterogeneous Photocatalysis

[0009] Titanium dioxide (anatase, brookite and rutile), the anatase phase is the titanium dioxide structure with the highest photocatalytic activity, in spite of being a metastable phase. Since Fujishima and Honda (Fujishima, A.; Honda, K., Nature 1972, 37, 238) discovered in the seventies the photocatalytic dissociation of water on titanium dioxide electrodes (Hashimoto K. et al. J. Appl. Phys. 2005, 44 (12) 8269), the development of a large amount of research based on this photocatalytic semiconductor started.

[0010] Support Materials.

[0011] The need to use supported photocatalysts emerged as a consequence of the high cost of filtration processes aimed at retrieving the photocatalyst. Nonetheless, there are also limitations to be considered when using supported systems. The difficulties in the use of supports are related to both the reduced contact between the pollutant and the photoactive material and the difficulty to achieve a total irradiation of the semiconductor particles. Until now, a large variety of materials has been tested in photocatalysis as a photocatalyst support. The majority of them is based on the use of SiO2 in both glass and fused silica or quartz. Currently, amongst the materials offering great potential as a support, microporous materials such as active carbon, mesoporous materials such as silica or alumina and organometallic compounds, amongst others, can be found. Materials with high transparency in the UV region, as it is the